

THE COEFFICIENT OF ABMODALITY AND THE HOMOGENEITY OF MALABAR SOLE POPULATIONS

ABSTRACT

Fifteen morphometric ratios in 29 samples of the Malabar sole *Cynoglossus semifasciatus* Day from five centres of the west coast of India were studied by means d/σ test after substituting the sample mean values for the single specimen values, and the overall mean value of all samples together for the single sample mean of the original method for calculating the value of d/σ . The results have shown a very high degree of homogeneity in the population along the coast, in confirmation of the general findings of the earlier work on this fish. Morphometric ratios and meristic counts are still the most practical criteria available to fish taxonomists in their day to day work.

Introduction

SIMPSON AND ROE (1939) have described a method for comparing single specimens with a sample to test their identity namely, the d/σ test also known as the coefficient of abmodality test; d here is the deviation of the value of the chosen character from the mean value of the sample while σ is the Standard Deviation (SD) of the mean. The significance of d/σ is evaluated from a Probability table based on the normal curve area table (Simpson and Roe, 1939).

Chakrapani and Seshappa (1982), and Seshappa and Chakrapani (1984 a, b, 1987, MS) studied the morphometric, meristic and selected biological characters in this fish from 29 samples collected from Malpe, Mangalore, Cannanore, Calicut and Cochin together, and concluded in general that the species is quite homogeneous in the characters of its populations along the coast though there were slight differences here and there to be reconciled, particularly between Cochin at the southern end of the series on the one hand and all the other centres taken together on the other. It was interesting in this connection to try additionally,

the coefficient of abmodality test for comparison of the morphometric ratios of the above work, with the results of this attempt which form the subject matter of this short note.

Method

The method is a modification of the d/σ method described by Simpson and Roe (1939) as mentioned in the introduction. The Probability and the statistical significance are determined as in the original method of the same authors.

Results

Table 1 shows the grand mean value (with SD, SE and CV and the range of sample mean values for 15 selected morphometric ratios in *Cynoglossus semifasciatus* from 29 samples from the above mentioned data of Seshappa and Chakrapani (1984 a, b, 1987). Table 2 shows the range of d/σ values derived as stated above, in three groups as follows: group I includes all values below 1.96; group II includes all values from 1.97 to 2.57 (both inclusive), and group III includes all the values of d/σ which are 2.58 and above.

Discussion and conclusion

Values of d/σ in group I have a Probability of more than 0.05 or 5% and are always non-significant; group III on the other hand, consists of values which are always significant with P level being less than 0.01 or 1%; in the intermediate group II the values may be said according to Simpson and Roe (1939) to be sometimes significant when they are equal to 2 or more, that is, there is an element of doubt for treating them as non-significant and so some allowance must be made for such cases while judging the final weight of the group III values in the total data.

Now, out of the total of 435 individual d/σ tests made here for all the ratios together, a total of 8 values fell into the group III, 17 into group II and all the rest (*i.e.* 410) fell into group I as can be seen from Table 2 (last column). The percentages of the three groups in the total tests made are found to be : group I — 94.25%, group II — 3.91% and group III — 1.84%. In group II, four values are above 2 and form 0.09% of the total and must be treated as possibly significant values, while the remaining 13 (= 2.99%) values are safely considered non-significant. Group III with 8

TABLE 1. Sample means and related statistics of 15 morphometric ratios of the Malabar sole *Cynoglossus semifasciatus*

Ratios	Range of means of samples (X)	Grand Means (\bar{X})	Standard Deviation (SD)	Standard Error (SE)	Coefficient of Variation (CV)
TL/HL(i)	4.6537 to 5.5346	5.0233	0.1868	0.0347	3.7187
TL/HL(ii)	4.2433 to 4.9271	4.5865	0.1682	0.0312	3.6673
SL/HL(i)	4.1217 to 4.8748	4.4905	0.1691	0.0314	3.7657
SL/HL(ii)	3.7561 to 4.4219	4.1049	0.1600	0.0297	3.8978
TL/Ht.	4.1629 to 4.4384	4.3224	0.0566	0.0105	1.3095
SL/Ht.	3.7282 to 3.9623	3.8701	0.0520	0.0097	1.3436
TL/SL	1.1082 to 1.1297	1.1180	0.0055	0.0010	0.4902
HL/Ht.(i)	0.8000 to 0.9288	0.8632	0.0332	0.0062	3.8462
HL/Ht.(ii)	0.8769 to 1.0180	0.9446	0.0374	0.0069	3.9593
HL(i)/Snt.	3.2042 to 3.6434	3.3539	0.0938	0.1174	2.7967
HL(ii)/Snt.	3.3566 to 3.9147	3.6651	0.1196	0.0222	3.2632
Snt./ED	3.5132 to 4.0467	3.8121	0.1296	0.0241	3.3997
HL(i)/ED	11.4805 to 14.0966	12.7376	0.4901	0.0910	3.8486
HL(ii)/ED	12.7994 to 15.2806	13.1183	0.4983	0.0925	3.8502
ED/IOW	2.2100 to 3.2544	2.6425	0.4055	0.0753	15.3221

Abbreviations : HL(i) = Head length to opercular angle; HL(ii) = Maximum head length; TL = Total length; SL = Standard length; Ht. = Maximum height; Snt. = Snout length; ED = Eye diameter; IOW = Inter orbital width.

TABLE 2. Range of d/σ values and their significance in 29 samples of Malabar sole *C. semifasciatus* (Figures in brackets indicate frequencies) (I, II and III are the groups of the d/σ values)

Ratios	Malpe (N = 46)	Mangalore (N = 319)	Cannanore (N = 243)
TL/HL(i)	I 0.57	I 0.25-0.76	I 0.32-0.83 II 1.98 (1)
TL/HL(ii)	I 0.33	I 0.03-0.70	I 0.07-1.56
SL/HL(i)	I 0.23	I 0.26-0.77 II 2.18(1)	I 0.10-0.77 II 2.18(1)
SL/HL(ii)	I 0.41	I 0.17-0.98	I 0.05-0.92 II 2.18(1)
TL/Ht.	I 0.75	I 0.05-0.78	I 0.04-0.11
SL/Ht.	I 0.27	I 0.03-0.87	I 0.76-1.22
TL/SL	I 1.69	I 0.05-0.58	I 0.44-1.78 II 2.13(1)
HL(i)/Ht.	I 0.11	I 0.28-0.92	I 0.37-1.11 II 1.98(1)
HL(ii)/Ht.	I 0.39	I 0.16-1.26	I 0.28-1.21 II 1.98(1)
HL(i)/Snt.	I 0.66	I 0.05-0.88	I 0.02-1.67 II 2.28(1)
HL(ii)/Snt.	I 0.95	I 0.13-0.44 II 2.60(1)	I 0.16-1.40 II 2.09(1) III 2.60(1)
Snt./ED	I 0.91	I 0.10-1.62 II 2.31(1)	I 0.37-1.81
HL(i)/ED	I 0.38	I 0.18-0.75 II 2.14-2.56(2)	I 0.39-0.77 III 2.78(1)
HL(ii)/ED	I 0.08	I 0.14-1.89 II 2.25(1)	I 0.35-1.03 III 2.73(1)
ED/MOW	I 0.39	I 0.11-1.50	I 0.14-0.97
Total	I 0.11-1.69	I 0.03-1.89 II 2.14-2.56(4)	I 0.02-1.81 II 1.96-2.57(6) III 2.73-2.78(2)

Significance — Group I : below 1.96; group II : 1.96-2.57; group III : 2.58 and above. Group I values are *clearly non-significant* while group III values are clearly significant. In group II, only the values of d/σ above 2 are likely to be significant and not those below 2.

TABLE 2 (Contd.)

Ratios	Calicut (N = 46)	Cochin (N = 319)	Total (All Centres) (N = 1530)
TL/HL(i)	I 0.38-1.75 II 2.74(1)	I 0.11-0.58	I 0.11-1.60 II 1.98(1) III 2.74(1)
TL/HL(ii)	I 0.17-1.79 II 2.18-2.50(2)	I 0.07-0.18	I 0.03-1.79 II 2.18-2.50(2)
SL/HL(i)	I 0.39-1.91 II 2.27(1)	I 0.12-0.15	I 0.10-1.91 II 2.18-2.27(2)
SL/HL(ii)	I 0.31-1.84 II 2.18(1)	I 0.42-0.64	I 0.05-1.84 II 1.98-2.18(2)
TL/Ht.	I 0.04-1.63 III 2.82(1)	I 1.64 II 2.05(1)	I 0.04-1.64 II 2.05(1) III 2.82(1)
SL/Ht.	I 0.16-1.38 III 2.73(1)	I 1.43-1.77	I 0.03-1.77 III 2.73(1)
TL/SL	I 0.0-1.62	I 0.42-0.58	I 0.00-1.62 II 2.13(1)
HL(i)/Ht.	I 0.08-1.90	I 0.43-0.48	I 0.08-1.90 II 1.98(1)
HL(ii)/Ht.	I 0.13-1.81	I 0.99-1.09	I 0.12-1.81 II 1.96(1)
HL(i)/Snt.	I 0.02-1.59	I 0.36 III 3.09(1)	I 0.02-1.67 II 2.28(1) III 3.09(1)
HL(ii)/Snt.	I 0.23-1.60 III 2.58(1)	I 0.11-0.77	I 0.11-1.60 II 2.09(1) III 2.58-2.60(2)
Snt./ED	I 0.06-1.84	I 0.13-0.89	I 0.06-1.89 II 2.31(1)
HL(i)/ED	I 0.01-1.75	I 0.02-0.49	I 0.01-1.75 II 2.14-2.56(2) III 2.78(1)
HL(ii)/ED	I 0.15-1.44	I 0.61-0.80	I 0.08-1.89 II 2.25(1) III 2.73(1)
ED/AOW	I 0.20-1.42	I 0.42-0.67	I 0.11-1.50
Total	I 0.00-1.91 II 1.96-2.57(4) III 2.58-2.82(4)	I 0.02-1.77 II 2.05(1) III 3.09(1)	I 0.00-1.91 II 1.96-2.57(17) III 2.58-3.09(8)

Significance : Total *non-significant* = 423 (i.e. 410 from group I and 13 from group II); clearly significant = 12 (i.e. 8 from group III and 4 of the highest values from group II). It emerges from these figures that 97.24% of d/σ the values examined are non-significant and 2.76% only are significant.

values above 2.58 form 0.18% of total tests made. Thus only 0.27% of the d/σ values are clearly significant and all the others are non-significant *i.e.* the differences between the two sets of values compared are statistically of no importance for the characters under consideration.

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These results thus confirm the earlier general conclusion of Seshappa and Chakrapani (1984 a, b, 1987) that populations of the Malabar sole *C. semifasciatus* were very largely homogeneous on the basis of samples examined in the period of sampling. The data of individual centres also show similar significance.

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